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ABSTRACT

This book helps individuals use Turtle Time Designs programs (i.e., a series of graphics program files to be used with LogoWriter) even if they have little previous experience with LogoWriter. The features of each program are carefully explained and are followed by step-by-step suggestions for teaching the lesson. Examples of the types of designs that can be made with each program are included throughout the book. A series of worksheets at the end of the book explain the commands used in the programs and give examples of how the designs were created. Learners of all ages, from preschool through adult, can use the programs, each at his/her own level of skill. This book explains how to use FreeDraw, Patterns, SpinPat, GrowPat, and SuperPat. The book begins with FreeDraw, a simple drawing program. With experience, students progress from making simple shapes to elaborate pictures. Free Draw lets students become comfortable with the way the turtle works and helps them gain control over its movements. In Patterns, students create a small "squiggle." SpinPat and GrowPat transform the pattern by rotating it around a central axis or increasing the length of each side. SuperPat allows combinations of transformations on each pattern. (TMK)

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Tricia S. Jordan holds a Ph.D. in early childhood education from the University of California, Los Angeles. Throughout her professional life, her work has focused on children and computers. For the past 10 years, Dr. Jordan has combined teaching with designing and programming educational software. She opened the Computer Workshop in 1980, developing pioneering computer curricula for students from two years of age through eighty-something. Dr. Jordan has written several books on computers and computer programming for children, including *The One-Hour Atari, The One-Hour Commodore, The Commodore for Your BASIC Kid,* and *The Apple for Your BASIC Kid*. She also has developed a series of bilingual prereading programs entitled *Rascal Takes a Ride/El Paseo de Rascal*.

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Turtle Time Designs

Working With Patterns in LogoWriter

Tricia S. Jordan

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From the Publisher

The purchaser of the *Turtle Time Designs* package receives this book, a data disk, and a single-user site license. The *LogoWriter* application is *not* included and *is* necessary for using the disk files.

The single-user site license gives the one person who is designated as the "primary user" of the *Turtle Time Designs* package the right to make copies of worksheets, disk files, and other material necessary for use in the classes he or she teaches. The right to copy materials from the book or the disk does not transfer to participants in classes taught by the primary user. If the single-user site license is purchased by a school or school district, the intent is that one person be designated as the "primary user." If several people are to use the book for teaching, a separate *Turtle Time Designs* package must be purchased for each individual teacher.

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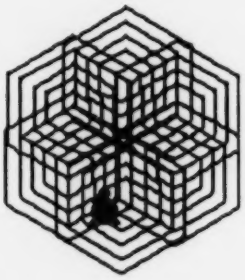
Overview

Turtle Time Designs provides a series of graphics program files on disk to be used with *LogoWriter*. Learners of all ages, from preschool through adult, can use the programs, each at his or her own level of skill.

The series begins with **FreeDraw**, a simple drawing program. Using one- and two-key commands, students move the Logo turtle, which leaves a line as it goes. With experience, students progress from making simple shapes to quite elaborate pictures full of bright colors, perhaps with poems or little stories added to them. FreeDraw lets students become comfortable with the way the turtle works and helps them gain control over its movements.

The remaining program files in the series use the turtle to create patterns, encouraging students to play with concepts of part-whole relations, repetition, permutation, nesting, and transformations.

In **Patterns**, students create a small "squiggle." A single keypress causes that squiggle to be repeated, making a pattern. Patterns are stored and can be easily called back in different places, colors, and combinations, making sensational designs.



SpinPat and **GrowPat** transform the pattern by rotating it around a central axis or increasing the length of each side. **SuperPat** allows combinations of transformations on each pattern. The result is a very powerful idea in a completely accessible, "mind-sized" bite.

The *Turtle Time Designs* disk containing these programs is available for the Apple II series, Macintosh, and MS-DOS computers. It requires the *LogoWriter* program (not included). Each program is a normal *LogoWriter* page and can be accessed as easily as any other *LogoWriter* page. The procedures on the flip side make an excellent tutorial for advanced *LogoWriter* programmers, both student and adult.

This book will help you use the *Turtle Time Designs* programs even if you have little previous experience with *LogoWriter*. No programming is required. The features of each program are carefully explained and are followed by step-by-step suggestions for teaching the lesson. To inspire you and your students, examples of the types of designs that can be made with each program are liberally sprinkled throughout the book.

The series of worksheets included at the end of *Turtle Time Designs* explains the commands used in the programs and give examples of how the designs are created. These worksheets are pictorial, so even prereaders can use them easily.

Chapter 1. Commands

The *Turtle Time Designs* disk contains a series of five *LogoWriter* programs. All the programs use the same basic set of commands, which are presented in this chapter. Most of these commands are single keystrokes, although some are two-key combinations. As the series of programs progresses, additional functions are added that require additional key commands. These new commands are explained in subsequent chapters, as they are needed.

Basic Commands

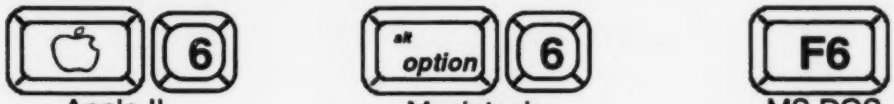
The basic keystroke commands, with pictures, appear on the worksheet Turtle Time Keys at the end of this book. There are three versions of this worksheet: one for Apple II, one for Macintosh, and one for MS-DOS systems. The basic keystrokes for all three types of computers are listed in the table below. A more detailed explanation follows the table.

Basic Keystrokes

Function	Apple II	Macintosh	MS-DOS
Move Forward 8 turtle steps	F	F	F
Move Backward 8 steps	B	B	B
Turn Right 30 degrees	R	R	R
Turn Left 30 degrees	L	L	L
Change the pen Color	C	C	C
Change the Screen color	S	S	S
Clear the screen	Ö6	Option/6	F6
Query: "Erase this picture?"	Y	Y	Y

Modifier Keys

Because the keyboards are different on Apple II, Macintosh, and MS-DOS computers, the Turtle Time command keys are slightly different for the three machines. In many cases the MS-DOS machines use the function keys, the Apple II systems use the equivalent number key modified by the Open Apple (Ó) key, and the Macintosh uses the number key and the Option key. If a modifier key is required, teach the students to hold the modifier key down first, then briefly touch and release the number key, and finally release the modifier key.



Apple II Macintosh MS-DOS

To Move

To move the turtle forward or backward, press the F or B key, respectively. Each press moves the turtle eight pixels, or dots. On the Apple II and MS-DOS computers, the keys repeat when they are held down, allowing the student to easily draw very long lines. The lines wrap around and around the screen, making a great pattern. The same result can be achieved on the Macintosh, but the keys must be pressed repeatedly.

To Turn

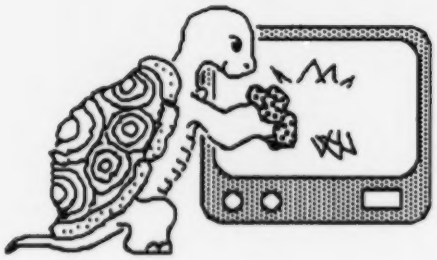
Each press of the R or L keys turns the turtle 30 degrees right or left, respectively. Turns are always relative to the turtle's current heading.

To Change Color

Pressing the C key changes the turtle's color, cycling through the colors available on the particular computer system. Lines are drawn using the currently selected turtle color. Pressing S cycles through the screen's available background colors, which may be different

from the available pen colors (MS-DOS). If the turtle seems to have disappeared or to have stopped drawing lines even though the pen is down, it is probably because the current line and background colors are the same. Change one color or the other and things should work correctly again.

To Clear the Screen



To clear the screen and start a new picture, use the Ö/6 combination on the Apple II series, Option/6 on the Macintosh, and the F6 key on MS-DOS machines. This erases the current picture, restores the original pen and screen colors, and moves the turtle, facing up, to the center of the screen. Because this action is irreversible, the query "Erase this picture? Y/N" appears in the Command Center at the bottom of the screen. If Y is pressed, the screen will clear. Any other key press causes the command to be ignored.

Advanced Commands

Advanced keystroke commands are shown on the Advanced Keys worksheet at the end of this book. These commands can be introduced to older students at the same time as the basic commands. Very young children, however, usually benefit from spending some time exploring the first set of commands before being introduced to the advanced commands.

As with the Turtle Time Keys worksheets, there are three versions of the Advanced Keystrokes worksheet: one for Apple II, one for Macintosh, and one for MS-DOS computers. The functions and commands for the three machines are listed in the table below and then explained individually.

Advanced Keystrokes

Function	Apple II	Macintosh	MS-DOS
Move Forward 1 step (Tiny Step)	⌘/F	Option/F	Alt/F
Move Backward 1 step (Tiny Step)	⌘/B	Option/B	Alt/B
Turn Right 2 degrees (Tiny Turn)	⌘/R	Option/R	Alt/R
Turn Left 2 degrees (Tiny Turn)	⌘/L	Option/L	Alt/L
Toggle between Pen Up/Pen Down	Return	Return	Enter
Fill a shape with color Query "Do you want to fill here?"	⌘/4 Y	Option/4 Y	F4 Y
Write a message Query "What do you want to write?"	⌘/8 enter message	Option/8 enter message	F8 enter message
Erase the latest message	Delete	Delete or Backspace	Backspace

To Move and Turn Precisely

As students gain experience with these commands, they eventually want to have more precise control of the lines they draw. The Tiny Step and Tiny Turn commands make this possible. Each uses the same F, B, R, and L keys discussed above, plus the modifier key for your computer shown in the Advanced Keystrokes table .

The Tiny Steps Forward and Backward move the turtle a single pixel step.

NOTE: The "pen" is located in the center of the turtle's body, so the end point of the line will be directly under the turtle. To see exactly what the line looks like, raise the pen (see below) and move the turtle away.

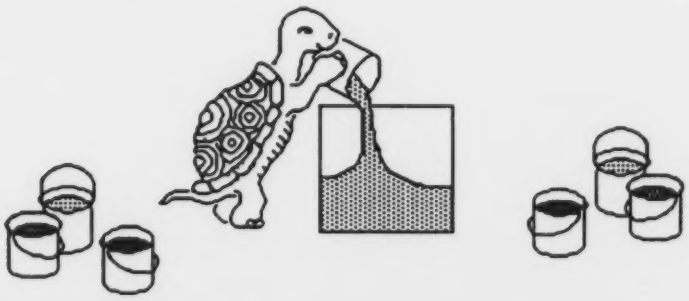
Tiny Turns turn the turtle two degrees. The turtle is not able to show such fine changes in its orientation visually on the screen, but the turtle's heading does actually change. Lines drawn will clearly show the new heading.

To Move Without Leaving a Line

Often students will need to move the turtle without leaving a line—to put eyes in the middle of a face, for example. To do this, lift the pen by pressing Return/Enter. The status message in the upper left corner of the screen will change from PEN DOWN, the initial state, to PEN UP. Pressing Return/Enter again will lower the pen so that lines are left behind the turtle as it moves.

To Fill a Shape With Color

Closed shapes can be filled with the current pen color. To do this, lift the pen and move the turtle inside the shape. Press ⌘/4, Option/4, or F4. The query "Do you want to fill here? Y/N" will appear in the Command Center. Press Y, and the area will fill with color. Any other key press causes the command to be ignored.



NOTE: If the shape to be filled is not perfectly closed, the color will "leak" irretrievably into the surrounding areas of the screen. On Apple II systems, it is recommended that white lines be used to draw shapes that are going to be filled because colored lines can sometimes leak even if they completely enclose an area.

To Write on the Screen

By Tricia

Text messages, such as a signature, a title, or a story, can easily be added to pictures.

There are five steps to writing a message:

1. Move the turtle to the place where the first letter is to appear.
2. For Macintosh and MS-DOS computers only, choose the color for the text by pressing C.
3. Press ⌘/8, Option/8, or F8. The query "What do you want to write?" will appear in the Command Center.
4. Enter a short message, using the Delete (Backspace) key to edit.
5. When the message is correct, press Return/Enter, and the message will move from the Command Center to the screen.

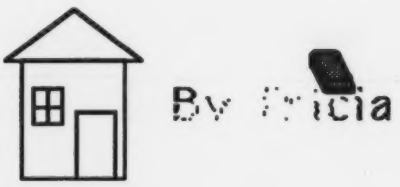
If the message goes beyond the right edge of the screen, it will wrap around to the left side of the screen *on the same line.* This is rarely the intended effect, but, as we will see in a moment, it can usually be erased. To write a multiline message, enter each line separately, move the turtle down the screen, and enter the next line.

On Apple II and MS-DOS machines, the letters automatically appear in preset row and column positions. On the Macintosh, text can appear anywhere. This allows some very interesting effects to be produced. For example, a student can write a message in light blue, move the turtle one pixel backward (Option/B) and write the same message in dark blue, creating a nice shadow effect.

To Erase a Message

As the student enters each message, the program adds it, plus its screen coordinates, to a list (named :mh, for "message history"). When the Delete or Backspace key is pressed, the turtle moves to the last pair of coordinates,

erases the message there, and returns to its original position. Pressing Delete/Backspace repeatedly will erase all the messages in reverse order. Messages can be erased from any color of background, but letters that cross colored areas (either lines or filled shapes) may not erase satisfactorily.



Hidden Commands

A few commands do not appear on the worksheets, allowing the teacher a certain amount of control over their use. Depending on the age of the students and the physical layout of the lab, you may wish to eventually teach your students some or all of these commands.

Additional Commands

Function	Apple II	Macintosh	MS-DOS
Quit the program and return to Contents Page	Escape	Escape, Clear, `, or Option/W	Escape
Query: "Are you sure you want to Quit? Y/N"	Y	Y	Y
Save a picture	Control/Ö/S	Shift/Opt/ S	Alt/S
Query: "Save this picture?"	Y	Y	Y
Query: "Name your picture"	filename	filename	filename
Change disk drive or pathname	Control/Ö/D	Shift/Opt/D	Alt/D
Query: "Enter new drive (name)	drive letter	pathname	drive letter
Print a copy of the picture	Control/Ö/P	Shift/Opt/P	Alt/P
Query "Print this picture?"	Y	Y	Y
Restart the program	type "CONT"	type "CONT"	type "CONT"

To Quit a *Turtle Time Designs* Page

To quit the page, press ESCape. (On the Macintosh, press Escape, the ` character, or Option/W, depending on your keyboard.) A query appears to make sure you really want to quit. If you answer Y, control returns to the Contents page. The current picture is not saved.

To Save a Picture

To save a picture, press S and the appropriate modifier key(s). The query "Save this picture on (passname/drive ___)? Y/N" appears in the Command Center. If Y is pressed, the computer asks for a single-word filename. If the name has more than one word, all but the first word will be ignored. The program checks the currently active disk to see if the name is unique. If it is not, it asks for another name.

Pictures are saved using the Logo command SAVEPIC. They are not regular Logo pages and will not appear on the Contents page. They can be listed from the *LogoWriter* Command Center with SHOW FILELIST and loaded with LOADPIC "*filename*.

Pictures take up a relatively large amount of disk space, and you may wish to store them on a separate disk. You can use any formatted disk.

To Save to a Different Drive

If you wish to save pictures on a disk that is not in the currently active drive, you need to change the pathname or drive designation that tells the computer where to save a file. To do this, press the letter D and the modifier key(s) shown in the Additional Commands table above. The current pathname or drive will appear in the Command Center at the bottom of the screen, and you will be asked what you want to change it to. You only need to change the drive once during a session; the new location remains active unless changed again, so all subsequent pictures will be there.

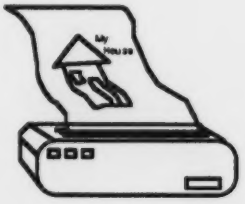
The program remembers the original pathname, and when you quit you will automatically return to the original location.

MACINTOSH NOTE: The pathname on the Macintosh is the name of the disk rather than the drive. The Macintosh allows spaces in a disk name, which can confuse Logo. Either change the name of the disk to remove all spaces or enclose the name with the "|" character (vertical bar). For example, if the disk is named GRADE 2 PICS, answer the query "Enter new pathname" with |GRADE 2 PICS|.

MS-DOS NOTE: If DOS has trouble finding the drive, it will put a message across the screen, spoiling the picture. Be sure that the drive is available on your system and that the formatted disk in the drive has sufficient room to store the picture.

To Print a Picture

If there is a printer connected to your system that can print regular *LogoWriter* pictures, simply press P and the modifier key(s) shown in the Additional Commands table. If you answer Y to the query "Print this picture? Y/N", the picture will begin printing. The picture will not fill a complete sheet of paper, and you will need to advance the paper manually to get ready for the next one.

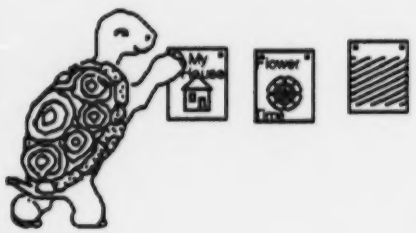


If there is no printer connected to the computer, you will need to save the students' pictures to a disk (see above), load them into a computer with a printer, and then print them out. This can be done directly from *LogoWriter:*

```
SHOW FILELIST
RG LOADPIC "filename
HT PRINTSCREEN
```

However, to make the process easier, a printer utility file is included on the *Turtle Time Designs* disk. It is called PRINTPIC and is a regular *LogoWriter* page.

To Print Pictures Using PRINTPIC



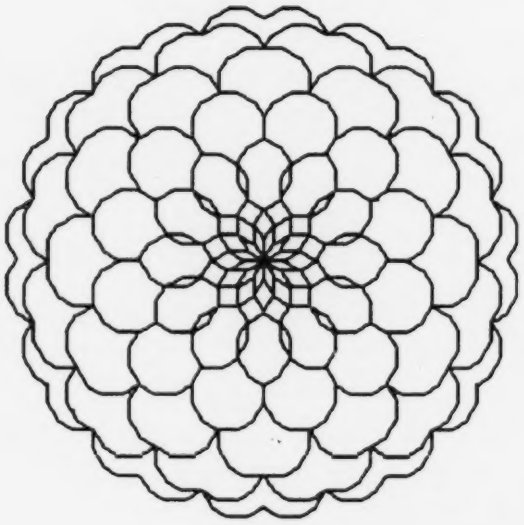
To use PRINTPIC, select it from the *LogoWriter* Contents page. A list of picture files will appear on the screen. If you need to change drives, move to that option, press Return/Enter, and enter the drive letter or disk name. To load a picture, move to its name and press Return/Enter. Answer Y to print as many copies as you wish. (You will need to advance the paper manually after each picture, and press Y again to print the next copy.) When you have finished printing, the program will ask if you wish to erase the picture from the disk to make room for more pictures. Answer Y or N, and the list of remaining pictures will appear.

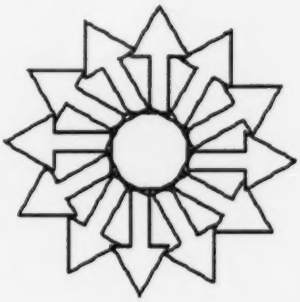
To print pictures from another disk, insert it in the same drive and select ANOTHER DISK from the list of options. You may need to enter the name of the new disk if asked.

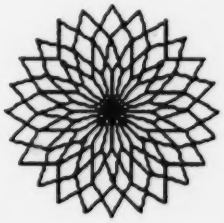
To Restart the Program

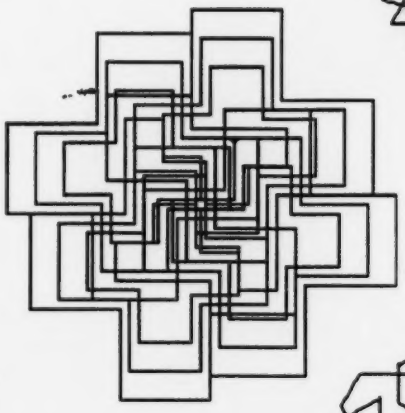
At some point, you may notice that the cursor is blinking in the Command Center at the bottom of the screen and key presses no longer move the turtle; instead, they print as letters in the Command Center. This means that you are now in *LogoWriter* rather than in *Turtle Time*. This can happen if something goes wrong while saving a picture, if the printer isn't ready when you asked it to print a picture, or if the student pressed the STOP command (Ⓒ/S, ⌘/. or Control/S). To restart the program, simply type CONT to continue where you left off (or as close to it as possible), or type STARTUP to start the program over.

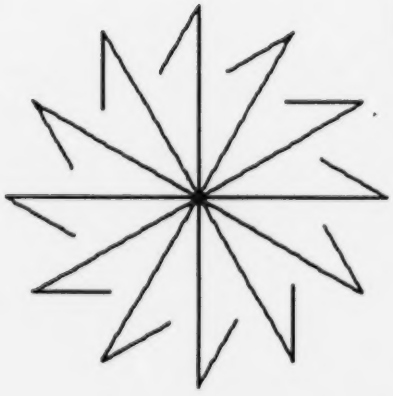
Now that you have all the basic commands for the *Turtle Time Designs* programs, let's explore the possibilities of each program separately.

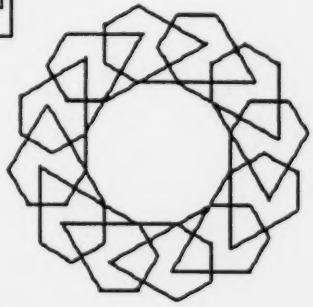


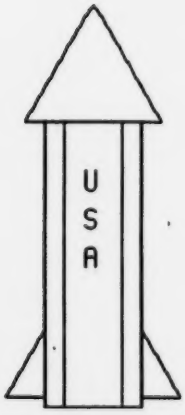








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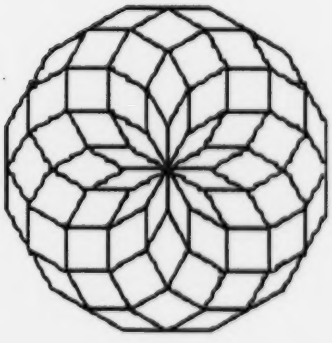
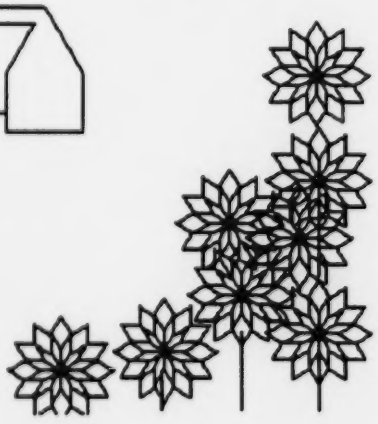




Chapter 2. FreeDraw

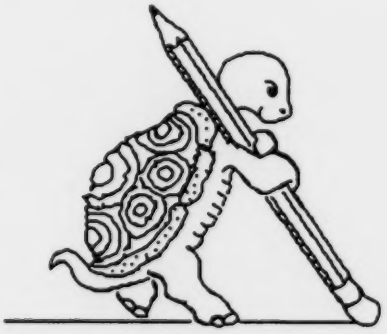
FreeDraw is the first of the programs in the *Turtle Time Designs* package. It is a simple drawing program that lets students draw pictures, color them in, add text, and print them out. It serves as a good introduction to the world of computers and to the world of Logo turtles.

Using FreeDraw

To use the programs on the *Turtle Time Designs* disk, boot *LogoWriter* as you normally would on your system and select the **FreeDraw** page. If you need help with this, consult your *LogoWriter* manual. The program begins automatically.

NOTE FOR ADVANCED PROGRAMMERS: If you are curious about the procedures that make up ***FreeDraw****, stop it as you would any* LogoWriter *procedure. Flip the page to see the procedures. To start up again, flip back and type STARTUP.*

To use **FreeDraw**, students need only press the keys described in Chapter 1. With three- and four-year-olds, just show them the F and R keys. After a few minutes, show them the C and S keys, and they will be content for a long time. Older students will quickly learn to use more of the FreeDraw features to make more sophisticated pictures.



To Erase a Line

All the commands and functions discussed so far have applied to all of the programs in the *Turtle Time Design* series. However, one command, PENERASE, is

available only in **FreeDraw**.

To erase lines, press ♂/E for Apple II, Shift/Option/E for Macintosh, or Alt/E for MS-DOS computers. The message PEN ERASE appears in the upper left corner of the screen, and the turtle will now erase a line 1 pixel wide as it moves. This allows the student to erase unwanted lines on empty areas of the screen. Lines across colored areas can usually be "erased" by changing the color of the turtle (C) and redrawing the line.

To turn off the PEN ERASE mode, simply press Return/Enter and the pen will return to its previous setting.

Trying to erase lines can be a frustrating process if the lines are complex. Use the Tiny Steps and Turns command to position the turtle exactly on the line to be erased. The PEN ERASE function does not appear on any worksheet, both because it is difficult for young children to use and because it is available only in **FreeDraw**.

Preparation

- Make a copy of the following worksheets found at the end of this book:

  Turtle Time Keys (Apple II, Macintosh, or MS-DOS version)

  Advanced Keys (Apple II, Macintosh, or MS-DOS version)

  Make-a-Shape

- Play with **FreeDraw** until you are comfortable with the program.
- Practice printing pictures. Make several to inspire your students. Keep your pictures simple enough to encourage your students rather than overwhelm them.
- If you wish to save the students' pictures on floppy disks, make one or more scrapbook disk (see your *LogoWriter* manual)

- Before the students arrive, load *LogoWriter* and display the *Turtle Time Designs* Contents page.

Procedure

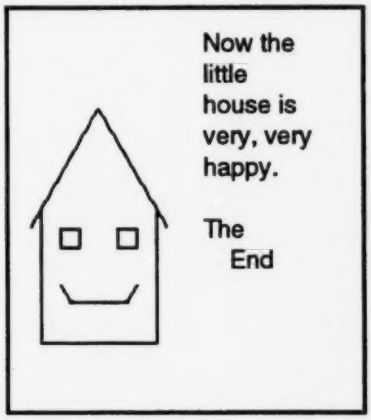
- Help the students choose the **FreeDraw** program.
- Pass out the Turtle Time Keys worksheet, which shows the basic **FreeDraw** commands.
- Rather than explain **FreeDraw** to the students, let them discover how it works by either pressing random keys to see the effect or by referring to the worksheet.
- Encourage the students to share their insights and results with each other.
- Some students may have trouble getting started. You might turn the turtle to an angle (not pointing straight up or sideways) and suggest that the student simply hold down the F key. It makes a great pattern!

NOTE: The keys do not automatically repeat in the Macintosh version of LogoWriter.

- After a few minutes, pass out the Make-a-Shape worksheet. There is no need to require that all students make the shapes shown, but some may enjoy the exercise.
- Ideally, the students should have several sessions with **FreeDraw** before moving on to the next programs. At some point, the students will notice limitations to the **FreeDraw** program. This is a good time to introduce the Advanced Keys worksheet. Again, let the students discover how the commands work and let them help each other.
- When students make pictures they are happy with, help them write their name or a title on their pictures.
- Print as many pictures as possible. Decorate the walls, illustrate stories, and/or send them home with the students.

Once there was a very sad house.

Then Susie moved in.


Now the little house is very, very happy.
The End

Chapter 3. Patterns

Patterns introduces the idea of using a small "squiggle" and then repeating it to form a pattern. These patterns can be stored and called back in different colors and at different places on the screen. This is very exciting, since even the youngest child can create quite spectacular pictures! For older students who are learning Logo programming, **Patterns** serves as a good introduction to the REPEAT command.

Pattern Functions and Commands

In addition to the basic functions and commands discussed previously in this book, **Patterns** adds some new ones.

To Make a Squiggle

The basic element of **Patterns** is the Squiggle: a small drawing that will be repeated to make a pattern.

To make a squiggle, use any of the following functions:

Regular Steps	F, B
Tiny Steps	F, B, plus modifier key
Regular Turns	R, L
Tiny Turns	R, L, plus modifier key
Line Color	C
Pen State	Return/Enter

A Squiggle

All the other functions are still available, but they will not be retained as part of the squiggle.

As each key is pressed, it is added to a list. Squiggles are meant to be fairly small, and if the list gets to be too long, the computer will beep and print the warning "Squiggle getting too big" in the Command Center at the bottom of the screen. Eventually, it will stop accepting new keystrokes and print the message "Squiggle full. Press P or Shift/6".

To Make a Pattern

When the squiggle is complete, press P to start a pattern. The status line at the top of the screen changes to read MAKING PATTERN, and on the screen a copy of the squiggle is drawn starting from the current turtle position and heading.

A Pattern

Each time P is pressed, the squiggle is repeated again. The computer remembers how many times P is pressed, but there is no limit to the number—except, perhaps, patience.

When the pattern is complete, is must be stored by pressing the Space Bar. Until it is stored, none of the other *Turtle Time Designs* commands will work.

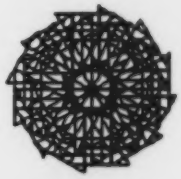
To Recall a Pattern

When a pattern is stored, it becomes associated with the number key 1. Previously stored patterns are shifted to the next higher number key. Thus, a particular pattern will be associated with 1 when it is first stored, and then moves to 2, 3, 4, and so on as each new pattern is stored. When it reaches the 0, it is lost.

To recall a pattern, simply press the number key with which it is associated. It will be drawn from the current heading and position and in the current color unless the squiggle itself contains color commands. Squiggle commands take precedence.

Several patterns make a design. To make a design, lift the pen, move to a particular position and press a number key. Change the turtle's heading or move to another position, and press the same or a different number key. Closed areas in or

between the patterns can be filled with color. Text can be added anywhere on the screen.



A Design

As you move about making a design, the computer adds your moves to its list, as if you were making a squiggle. Each time you recall a pattern, the list is emptied. It is possible, however, to fill up the list before you have finished your design. If this happens, you will get the Squiggle Full warning message on the screen. Simply press Shift/6 (the ^ character), and the list will be emptied without disturbing your design.

When the picture is finished, it can be saved, printed, or just erased to clear the way for a new picture.

Preparation

- Have on hand for reference the following two worksheets found at the back of this book:

  Turtle Time Keys (Apple II, Macintosh, or MS-DOS version)

  Advanced Keys (Apple II, Macintosh, or MS-DOS version)

- Make copies of these worksheets:

  Squiggle Patterns

  Pretty Patterns

- Play with **Patterns** until you are comfortable with it. Decide on a few simple squiggles that make effective patterns you can demonstrate.

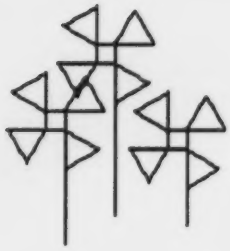
- Set up one computer so that all the students can see the screen. Load *LogoWriter* and display the *Turtle Time Designs* Contents page.

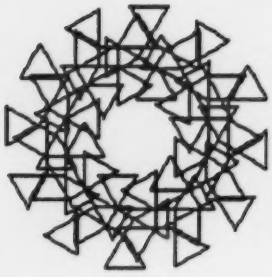
Procedure

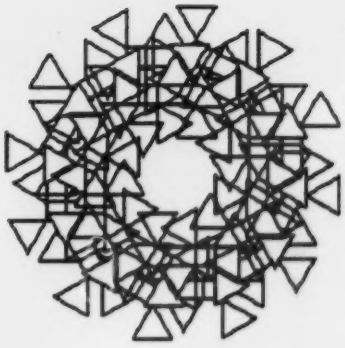
- Sit at the selected computer. Gather the students around so they can see the computer screen. Select the **Patterns** program.
- Explain that today they will make little squiggles and then repeat them to make interesting patterns.
- Use F, B, R, and L to make a squiggle, calling out the keys as you press them. Explain that the computer is remembering the keystrokes. The squiggle can't be too long. If it is, the computer will start beeping at you and then stop accepting keystrokes.
- Press the P key to repeat the squiggle. Press it repeatedly, pointing out how each press makes another copy of the squiggle until a pattern appears.
- When the pattern is complete (i.e., the turtle begins to trace its own steps), press the Space Bar. The screen will clear.
- Explain that the computer remembers your patterns. When you want one again, just press a number. Demonstrate by pressing 1.
- Clear the screen and make another squiggle and pattern. If you have color monitors, use the C key to change color several times in the squiggle.
- Explain that the computer keeps the patterns in a line, just the way the students line up to go back to class. Every time you make a new pattern, it crowds in at the front of the line, pushing the others back. Press the 1 key to get the new pattern. Press the 2 key to show that the old pattern is still there too.
- Pass out the Squiggle Patterns worksheet. If the students seem to need more instruction, make the pattern on the worksheet as a demonstration. Otherwise, let them go to the computers and try it on their own.
- Pass out the Pretty Patterns worksheet, which has examples of patterns. Encourage students who want to

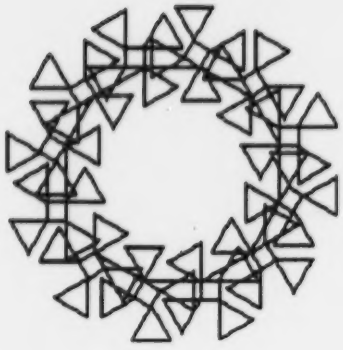
make their own patterns to do so. Have the others copy the ones on the worksheet until they feel comfortable with the process.

- Encourage the students to share their patterns with each other.
- Print as many pictures as possible.









Chapter 4. SpinPat

SpinPat builds on the ideas explored in **Patterns**. In **SpinPat**, the pattern spins around in a circle, creating a beautiful symmetrical pattern. The patterns are particularly beautiful when they are superimposed, especially in contrasting colors.

This is a great program for making snowflakes for a winter bulletin board.

Using SpinPat

The commands for **SpinPat** are identical to those in **Patterns**. The result, however, is quite different.

The student still makes a squiggle and presses P to turn it into a pattern. Now, however, after each press of the P the turtle returns to its starting point and turns 30° to the right. Eleven Ps (plus the original squiggle) result in a perfect circular pattern as the squiggle spins 360°.

The pattern is originally made around the center of the screen, but after it is stored it can be placed anywhere. Move to a new place on the screen and press the number of the pattern. It will appear, centered around the turtle's position.

Preparation

- Make copies of the following worksheets found at the end of this book:

  Spinners

  Mystery Spinners

- Play with **SpinPat** until you are comfortable with it.

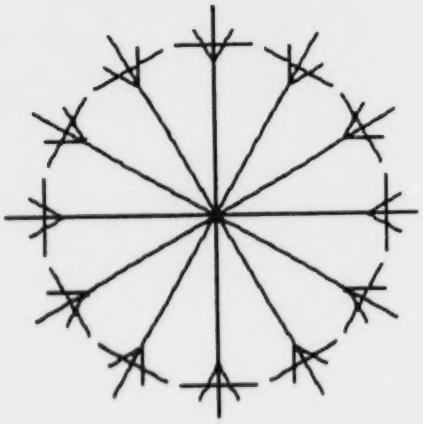
Procedure

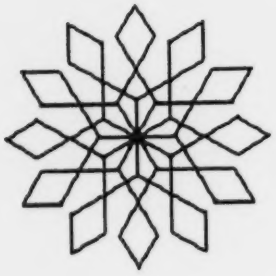
- Help the students select **SpinPat**.
- Explain that the program is very similar to **Patterns**. They use the same keys to make a squiggle, and press P to turn it into a pattern. However, the pattern it makes is different.
- Let the students experiment with the program and discover the difference. Help them verbalize it.
- Pass out the Spinners worksheet, which gives examples of patterns that can be made with **SpinPat**. The patterns on the worksheet are for inspiration only—there is no need to require the students to do them. Have some reference copies of the Turtle Time Keys, Advanced Keys, and Squiggle Patterns worksheets on hand for those who forget the keystrokes.
- Encourage creative use of the program. Let the students look at each other's results and freely share ideas.
- Print lots of pictures.
- After several sessions with **SpinPat**, when the students have a solid intuitive understanding of the relationship between the original squiggle and its resulting pattern, pass out Mystery Spinners. Challenge the students to figure out how each pattern was made. Answers are shown below, but don't be in any hurry to tell the students. And be aware that there are usually several ways to get the same result. If a student's solution results in the same pattern, it is just as valid as the one shown on the answer sheet, no matter how much it differs.

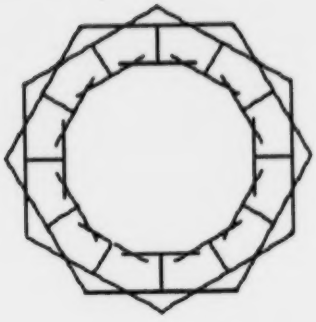
Answers To Mystery Spinners

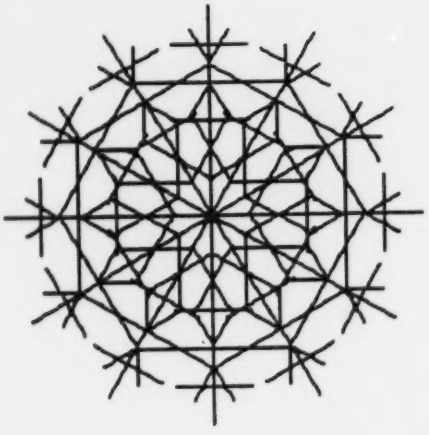
1. Squiggle: FFF
   Pattern: (P 11 times)
2. Squiggle: FF RRR F BB
   Pattern: (P 11 times)

3. Squiggle: FFFFF R BB
   Pattern: (P 11 times)
4. Squiggle: PenUp F PenDown F
   Pattern: (P 11 times)
5. Squiggle: PenUp FF PenDown R F LLLL F LLLL F
   Pattern: (P 11 times)
6. Make two Patterns
   Squiggle 1: PenUp F PenDown RRR F BB
   Pattern 1: (P 11 times)
   Squiggle 2: PenUP FFF PenDown RRR F LLL FF LLL FF LLL FF LLL F
   Pattern 2: (P 11 times)
   Design: 1 2
7. Squiggle: FF RR FF RRRR FF RR FF
   Pattern: (P 11 times)
8. Squiggle: FFFF RRR (FL 12 times)
   Pattern: (P 11 times)
   Design: 1 PenUp, then move to circles, and fill them with color
9. Squiggle: FF RR FF LLLL FF LL FF LLLL FF
   Pattern: (P 11 times)









Chapter 5. GrowPat

GrowPat is another expansion of **Patterns**. Now the squiggle grows with each repetition, resulting in an expanding pattern. The result is both beautiful and interesting, often appearing to have depth. Some patterns create optical illusions and seem to vibrate as you look at them.

GrowPat also provides an excellent opportunity to explore the Logo idea of beginning and ending turtle states and the relationship between the two.

Using GrowPat

All the commands and functions introduced in **Patterns** work in **GrowPat** as well. The student makes a squiggle and presses P to make a pattern. Now, however, each repetition grows. Every regular step forward (F) or backward (B) starts out as eight pixels in length. With every press of P, the length of each F and B in the squiggle is increased by one pixel.

Tiny Steps (and all turns) are not affected.

Because the turtle's position and heading (its "state") are changed after a pattern is called back, the pattern will be shifted and/or rotated if it is called back again. You can therefore often get great designs simply by recalling a pattern several times.

The incorporation of patterns into larger designs—hierarchical or nested patterns—moves the lesson to a new level of complexity. At first, students will just be pleased with their accidental results. As they experiment more, however, many will want more control over their pictures.

You can help by pointing out the turtle's state at the beginning and after it has drawn a design. The effect of the position is easy to understand—it starts from *here* instead of *there*. The effect of the heading is more difficult, but it is the thing that makes some patterns repeat in a line, some "curl up," and some just endlessly flip-flop between two versions.

Preparation

- Make copies of the following worksheets found at the end of this book:

  Growers

  Mystery Growers

- Play with **GrowPat** until you are comfortable with the program.
- Experiment with nested patterns. Make one pattern and call it back repeatedly. Try moving and/or turning between repetitions.
- Explore the effect of the turtle's beginning and ending states by trying the following:
  - ▲ Make a simple squiggle and press P a certain number of times, noting the turtle's position after the last P. Store the pattern (Space Bar).
  - ▲ Make the same squiggle and press P a different number of times so that the turtle is heading a different direction at the end. Store this pattern as well.
  - ▲ Recall each pattern several times and note the difference in the resulting designs.

Procedure

- Help the students select **GrowPat**.

- Explain that **GrowPat** is similar to **Patterns** and **SpinPat**. They make a squiggle and turn it into a pattern, but now the pattern is different.
- Let the students explore the program and discover (and verbalize) the transformation of the pattern.
- Pass out the Growers worksheet, which gives examples of patterns that can be made with **GrowPat,** to those who need a little help getting started.
- Encourage creative use of the program. Let the students look at each other's results and freely share ideas.
- Those students who are ready will make nested patterns, but many will be content with single patterns. This is fine. As the students gain experience with the program, they will use it in more complex ways.
- After the students have become experienced with **GrowPat**, pass out Mystery Growers. Challenge the students to figure out how the patterns were made. Possible answers are shown below.

Possible Answers to Mystery Growers

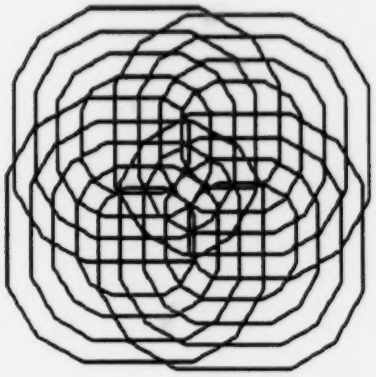
1. Squiggle: FRR
   Pattern: (P 29 Times—stop with turtle heading up)
2. Squiggle: same as 1
   Pattern: same as 1
   Design: 1 many times
3. Squiggle: LL (FR 12 times) RR
   Pattern: P many times
   Design: 1 (R 6 Times) 1
4. Squiggle: FR
   Pattern: (P 30 Times--stop with turtle heading 210° (down/left))
5. Squiggle: same as 4

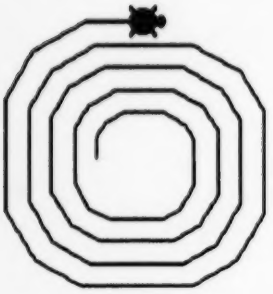
Pattern: same as 4

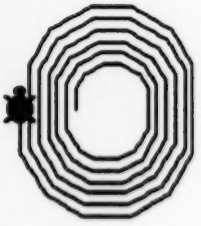
Design: (1 12 times)

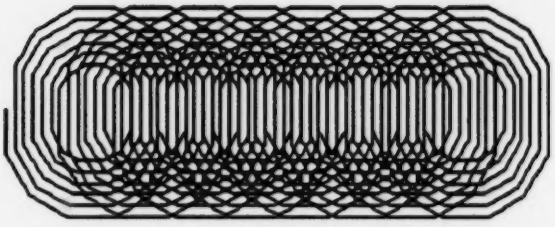
6. Squiggle: FF RR F (R 5 times) FF RRR

Pattern: P many times









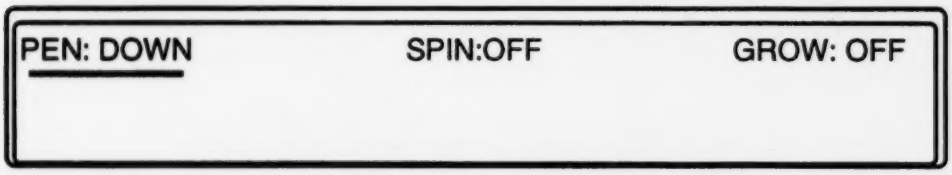
Chapter 6. SuperPat

SuperPat is the culmination of the *Turtle Time Designs* series. With **SuperPat**, students make a squiggle and then repeat it, spin it, or grow it, or spin *and* grow it!

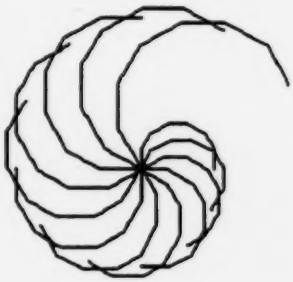
How SuperPat Works

SuperPat is a little different from **Patterns**, **SpinPat,** and **GrowPat**. The top of the screen, where the Pen Status has appeared previously, has been expanded. The Pen Status (Up or Down) still appears on the left, Spin Status (On or Off) appears in the center, and Grow Status (On or Off) appears on the right.

A bar indicates which status area is currently selected. It can be moved by using the arrow keys or the Space Bar. Pressing Return/Enter toggles the selected function between its two states.



When both Spin and Grow are turned off, **SuperPat** is identical to **Patterns**. When Spin is on and Grow is off, it is identical to **SpinPat**, and when Spin is off and Grow is on, it mimics **GrowPat**. However, when both Spin and Grow are on, there is a new result: the pattern spins around a central point, growing with each repetition.

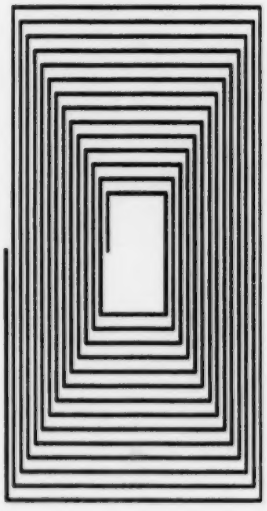


As the keys are pressed to form a squiggle, they are recorded. The status

settings, however, are not. Therefore, when any squiggle is recalled, it appears with the transformations selected at the time of its recall, regardless of the settings during its creation.

With **SuperPat**, a student can make a squiggle and call it back in several forms for comparison, solidifying the concepts of the earlier programs. Different transformations can be combined or superimposed to create ever more complex and wonderful designs.

Preparation



- Make copies of the following worksheets found at the end of this book:

  Super Pats

  Super Mystery

- Play with **SuperPat** until you are comfortable with it.
- Practice recalling patterns with different settings.

Procedure

- Help the students select **SuperPat**, but ask them not to start work yet.
- When the **SuperPat** screen is showing, point out the status line at the top of the screen. Let them experiment with moving the bar to the three areas and toggling the status with Return/Enter.
- Explain that turning things on or off in the status line changes the way the pattern is drawn.
- Challenge the students to discover how the program works.

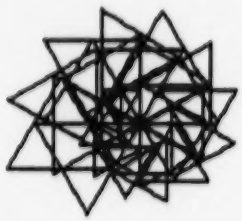
- After a few minutes, pass out the Super Pats worksheet and point out that it shows how a single squiggle can result in three very different patterns. Don't overexplain—it doesn't really matter if the students (especially the younger ones) can explain what is happening. They will be able to use it just fine.
- Print lots of pictures!
- Now is the time for projects. Cut out the designs, color them, and use them to decorate things. Make Christmas, Valentine's Day, Mother's Day, or Father's Day cards and write poems on them. Make a bulletin board. Wallpaper the computer room!
- At some point you may wish to challenge your students with Super Mystery. All the designs are made from the same squiggle and pattern.

Answers To Super Mystery

Squiggle: FFF L FF RR FF RRRR FF RR FF

Pattern: (P 12 times)

Design 1: SPIN: OFF
GROW: OFF

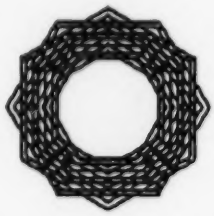


Design 2: SPIN: ON
GROW: OFF

Design 3: SPIN: ON
GROW: OFF

Pen Up, move to flags, and fill them with color

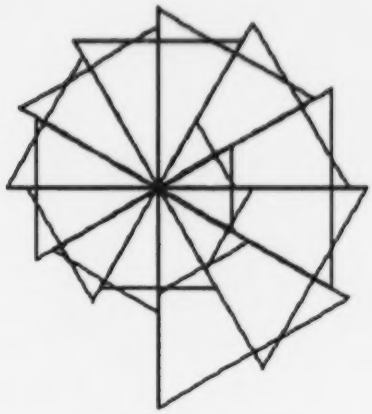
Design 4: SPIN: ON
GROW: OFF
1 (7 Tiny Turns) 1



Design 5: SPIN: ON
GROW: ON

Design 6: SPIN: ON
GROW: ON
RRR 1 (R 5 times) 1

Design 7: SPIN: ON
GROW: ON
1 a bunch of times



Apple II

Turtle Time Keys

Forward

Backward

Right Turn

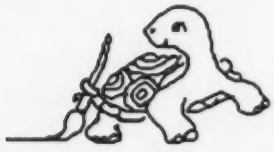
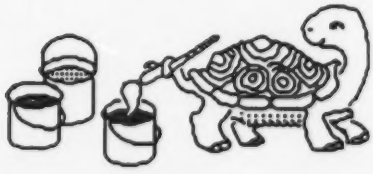
Left Turn

Color of pen

Screen color

Clear

Turtle Time Keys

Forward	F	
Backward	B	
Right Turn	R	
Left Turn	L	
Color of pen	C	
Screen color	S	
Clear	F6	

Macintosh

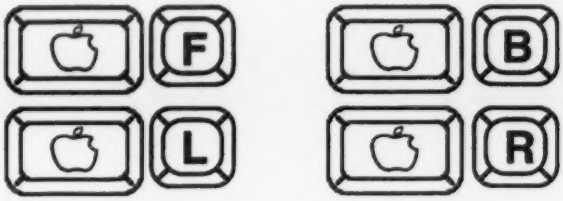
Turtle Time Keys

Forward	F	
Backward	B	
Right Turn	R	
Left Turn	L	
Color of pen	C	
Screen color	S	
Clear	option 6	

Apple II

Advanced Keys

Tiny steps and turns



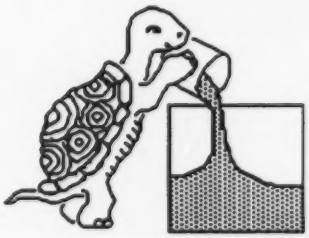
Move without a line

PEN UP

Make a line again

PEN DOWN

Fill a shape with color



Write a message

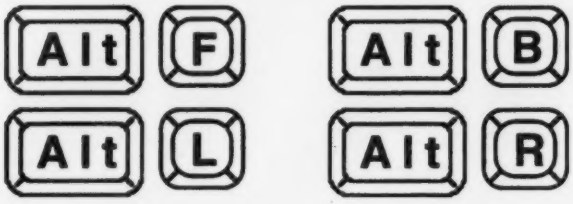
By Tricia

Erase a message

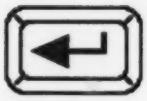
By Tricia

Advanced Keys

Tiny steps and turns



Move without a line

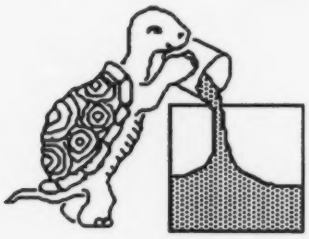


PEN UP

Make a line again

PEN DOWN

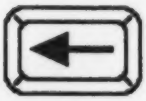
Fill a shape with color



Write a message

By Tricia

Erase a message



Macintosh

Advanced Keys

Tiny steps and turns

alt option F

alt option B

alt option L

alt option R

Move without a line

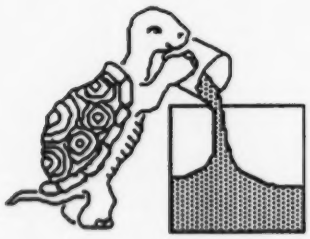
return

Make a line again

return

Fill a shape with color

alt option 4



Write a message

alt option 8

By Tricia

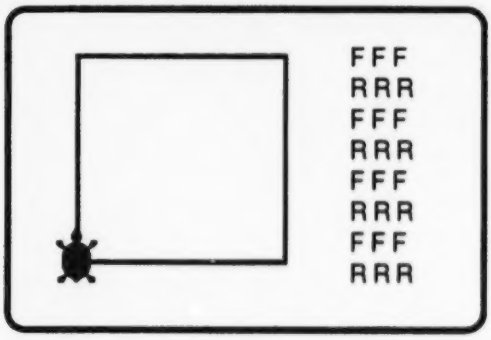
Erase a message

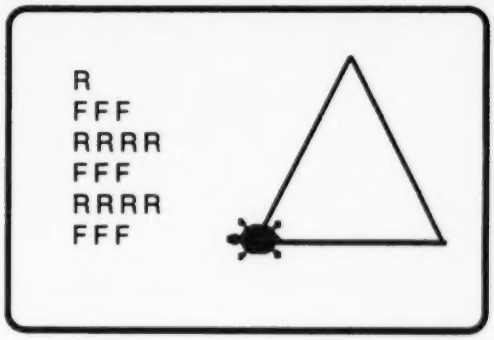
delete

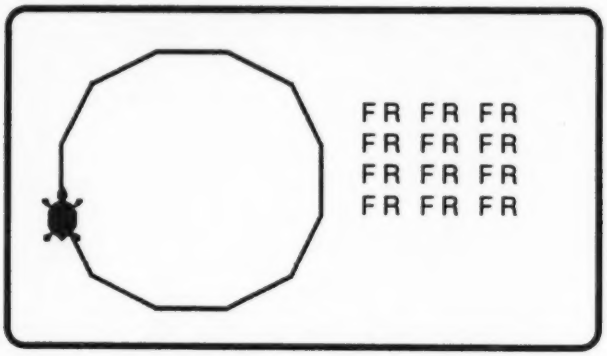
By Tricia

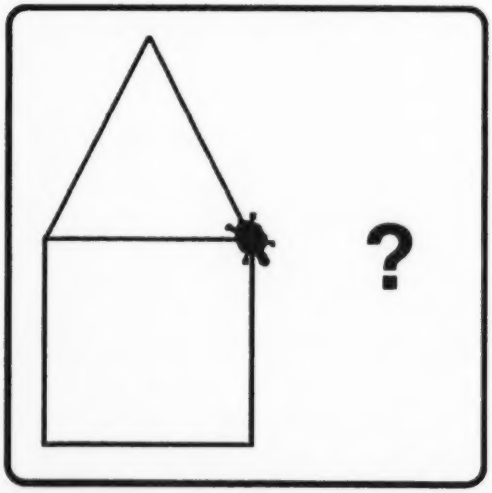
Make-a-Shape

DIRECTIONS: Try these shapes, and then make up your own.









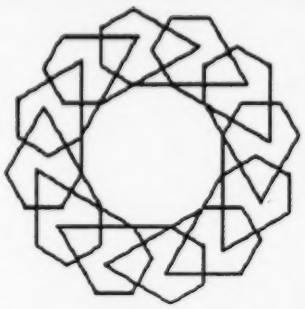
Squiggle Patterns

Draw a little squiggle.

```
FFFFFFR
FFRR
FFRR
FFRR
FFFF
RRRR
```

Press **P** to make a pattern.

```
PPP
PPP
PPP
PPP
```



Press [Space Bar] to store your pattern.

Press [1] to get your pattern back.

Pretty Patterns

DIRECTIONS: Try these patterns, or make your own.

FR FR FR
FR FR FF
FR FR FR
FR FF

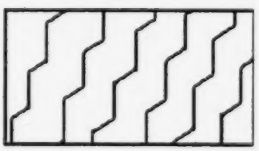
P P P
P P
Space

F F F F R
B B R F

P P P
P P
Space

F F F F R R
F F L L

P P P
P P P
P P .
. . . . .
Space



F F F R R R
F F F R R R
F F F R R R
F F F R

P P P
P P
Space

F F F R R
F F R R
F F R R
F F F L

P P P
P P P
P P P
P P
Space

Spinners

DIRECTIONS: Try these spinning patterns, or make your own.

F F
R R
F F

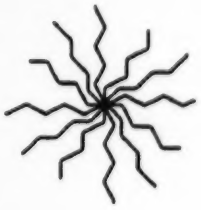
PPPP
PPPP
PPP
SPACE

FF FF LL
FR FR
FR FR
FR FR
FR FR
FR FR
FR FR

PPPP
PPPP
PPP
SPACE

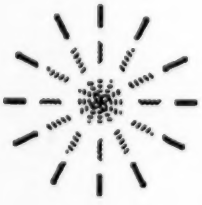
FF RR
L FFF
FF RR
FF LL
FF

PPPP
PPPP
PPP
SPACE



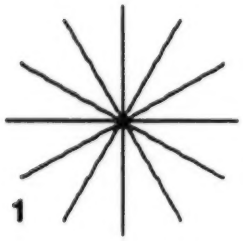
C F
Return F
Return C F
Return F
Return C F

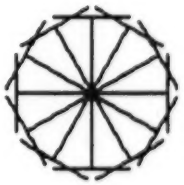
PPPP
PPPP
PPP
SPACE

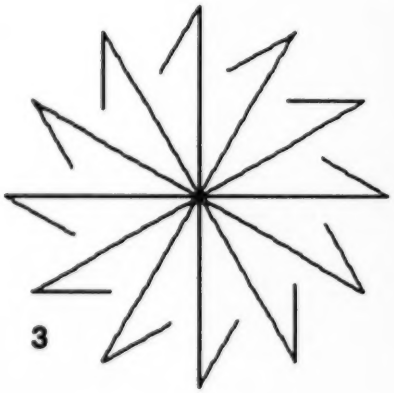


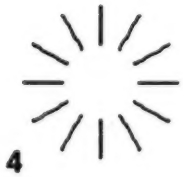
Mystery Spinners

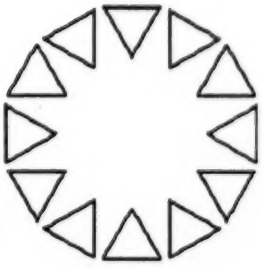
DIRECTIONS: Figure out how these patterns were made.
Hint: Sometimes you have to pick up the pen.

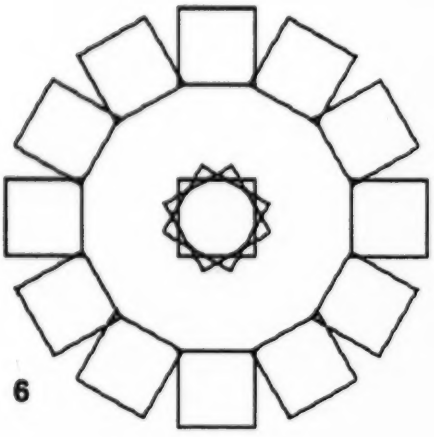

1

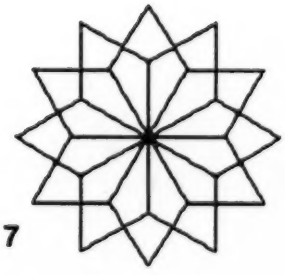

2

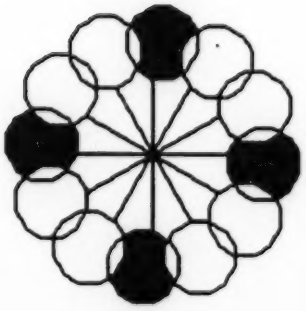

3

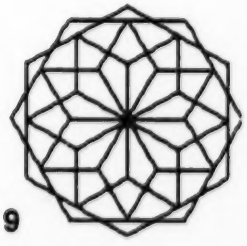

4


5


6


7


8


9

Growers

DIRECTIONS: Try these growing patterns, or make your own.

FF RRR
FF RRR
FF RRR
FF RRR

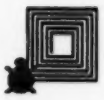
PPPPP
PPPPP
SPACE

F RR
F RR
F RR
F RRR
FF

PPPP
PPPP
PPP
SPACE

F
R R R

PPPP
PPPP
PPPP
PPPP
PPPP
PPP
SPACE

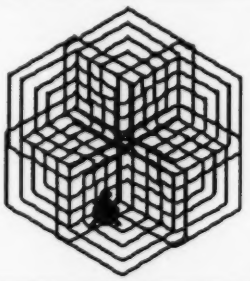


1
1
1

F
R R

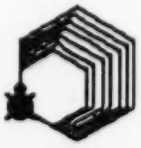
PPPPPP
PPPPPP
PPPPPP
PPPPPP
SPACE

1 1
1 1
1 1

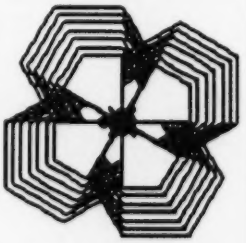


FF RR
FF RR
FF RR
FF RR
FF RR
FF RR

PPP
PPP
SPACE



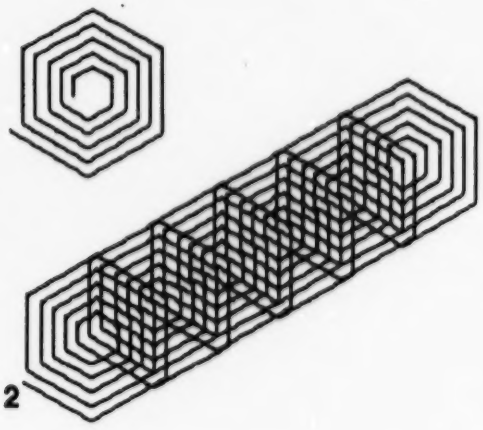
1RRR
1RRR
1RRR
1RRR



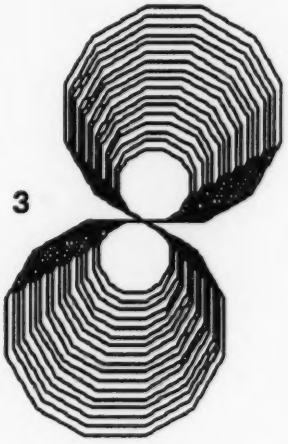
Mystery Growers

DIRECTIONS: Figure out how these patterns and designs were made. Hint: Sometimes you have to reuse a pattern.

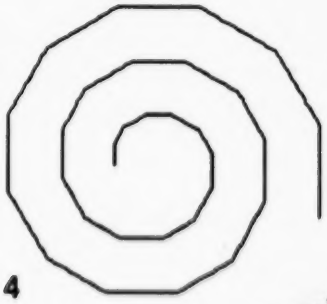
1



2



3



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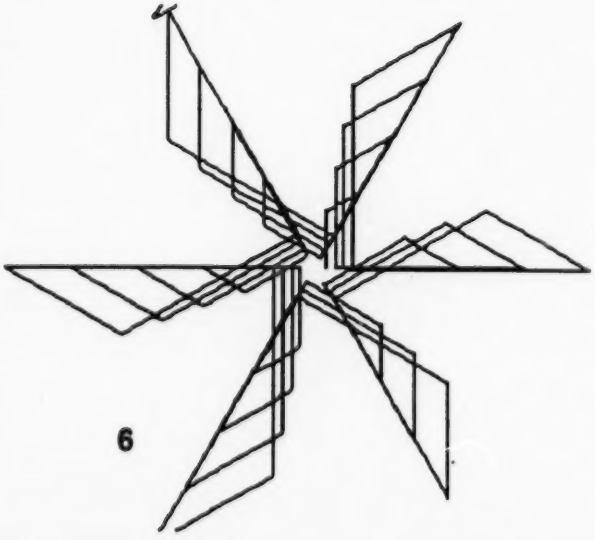
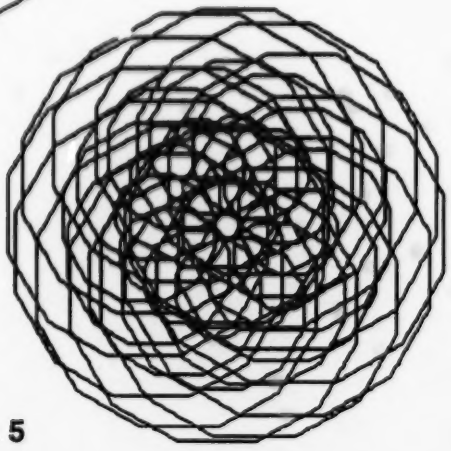


6



5

Super Pats

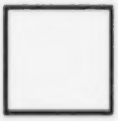
DIRECTIONS: Try this pattern, then make your own.

1 Start with a squiggle.

```
pen:down    spin:off    grow:off

FFF
RRR
FF
```

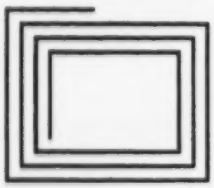
2 Make a pattern.

```
pen:down    spin:off    grow:off

PPP
PPP
PPP
PPP
SPACE
```



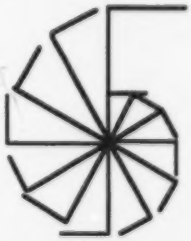
3 Play with the settings, and call it back.

```
pen:down    spin:off    grow:on

1
```



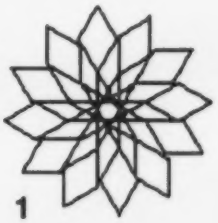
```
pen:down    spin:on     grow:off

1
```

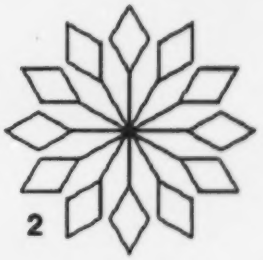
```
pen:down    spin:on     grow:on

1
```



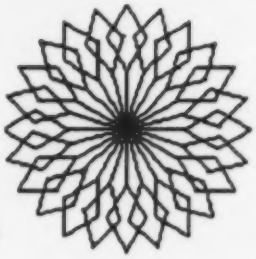
Super Mystery

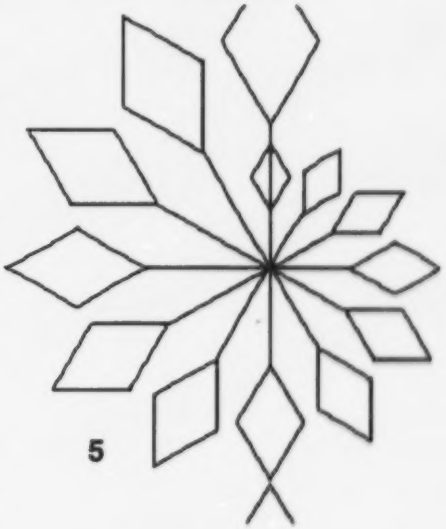
DIRECTIONS: Make just one pattern, and turn it into these designs.

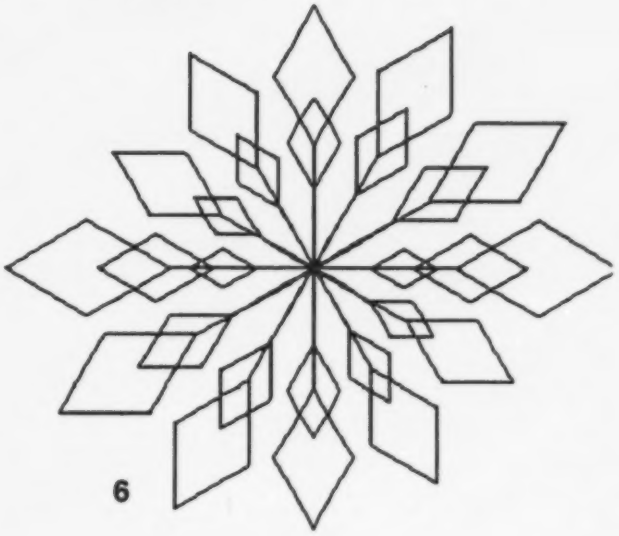

1

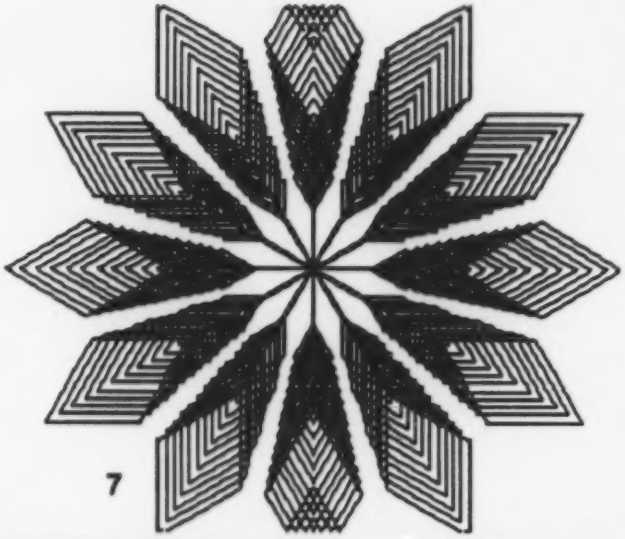

2

3


4


5


6


7

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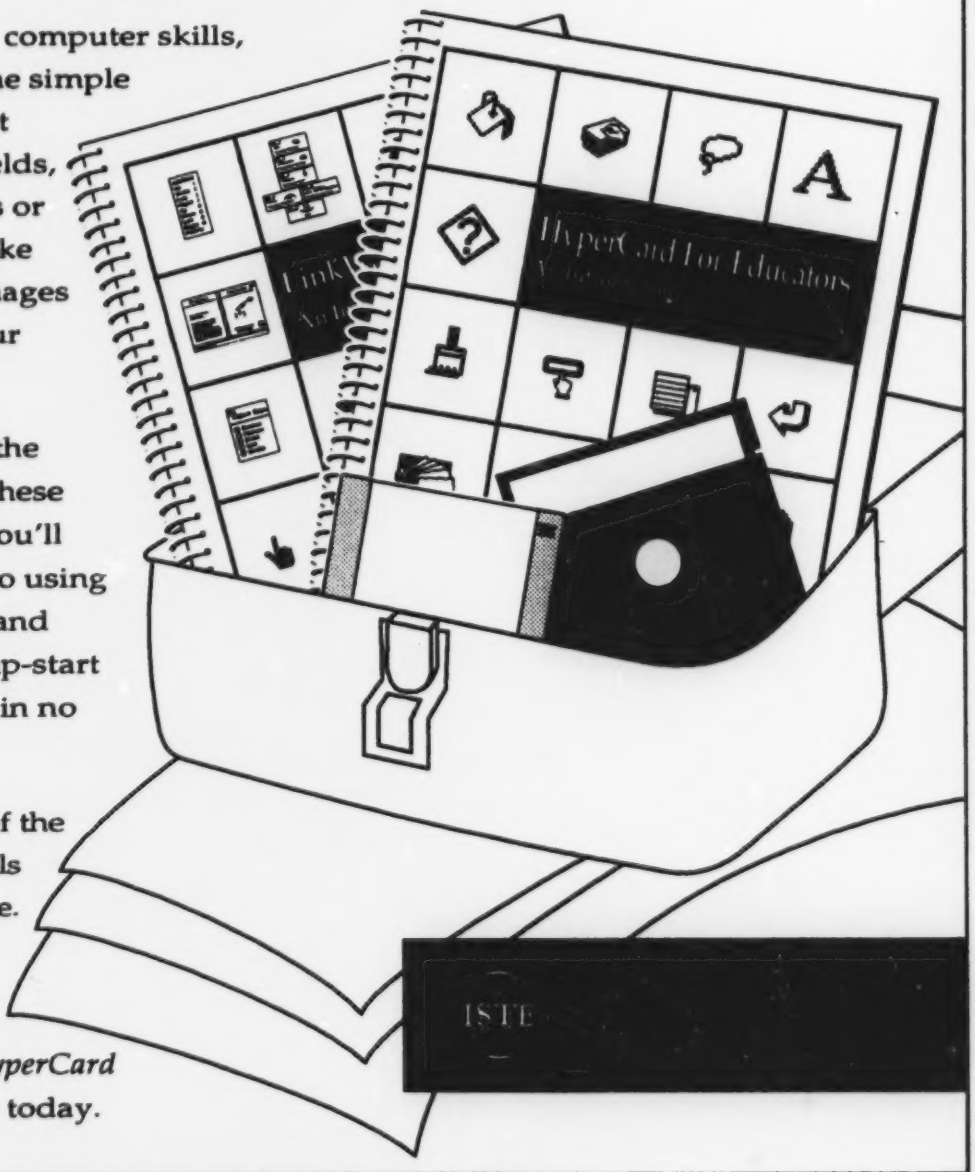

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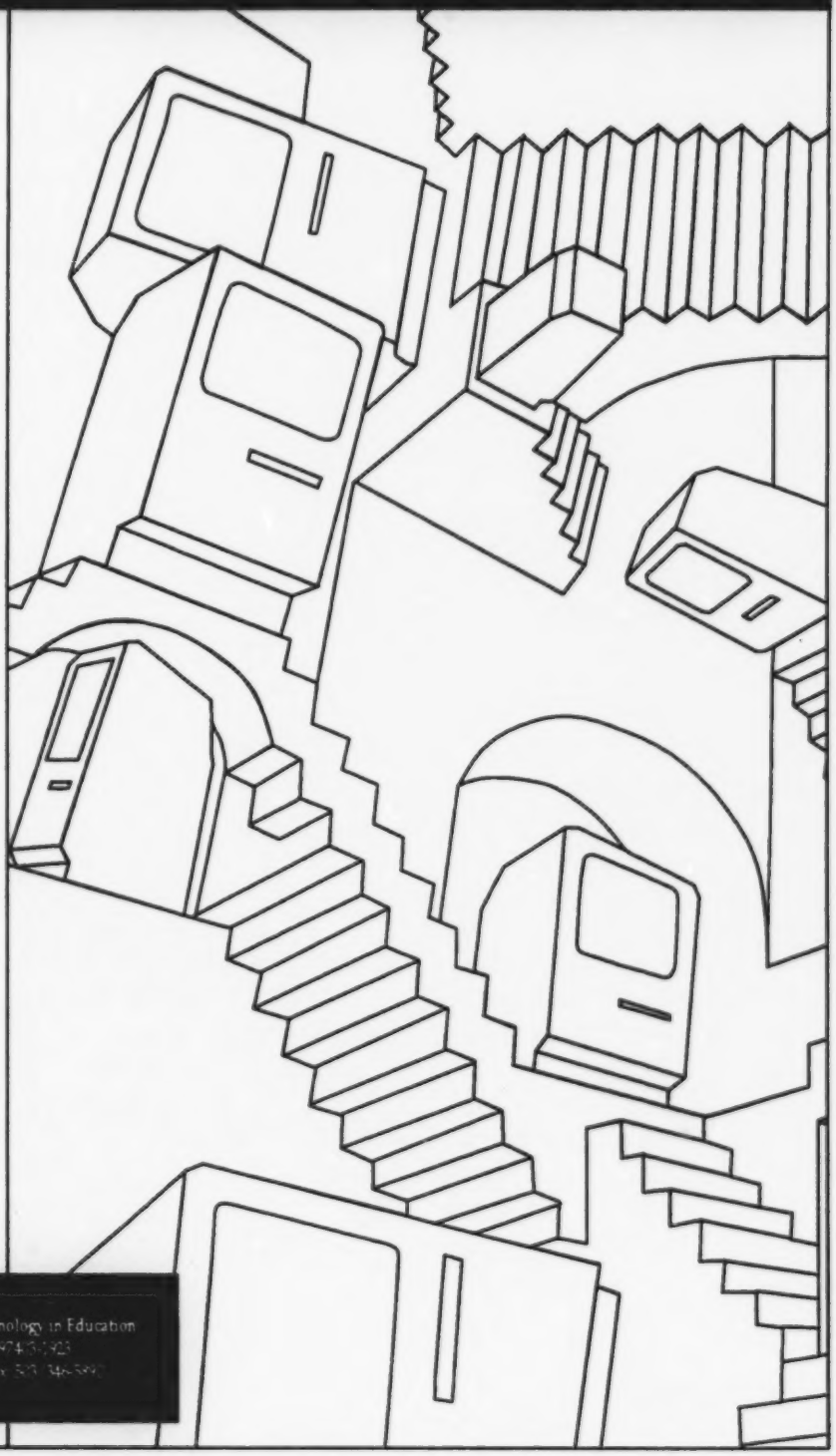

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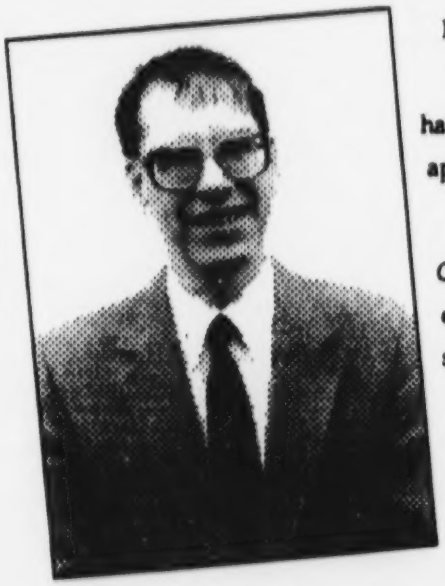
Dave Moursund knows...



ISTE Executive Officer Dave Moursund is dedicated to improving education.

Since he first began working with computers in education in 1963, Dave has constantly sought to improve education at all levels through the use of appropriate computer-related technology.

As a continuing part of this effort, Dave's newest book—*The Technology Coordinator*—discusses the goals of education and how teachers and teachers of teachers can join in the enormous change process facing today's schools.

This book was written for educators who want to play a leadership role in the instructional use of technology. Dave uses interviews with technology coordinators to illustrate the needs, roles, and qualifications needed to accomplish the goals of educational technology.

In recent years, Dave has focused much of his writing efforts on problem solving and on staff development. Some of Dave's other books also available from ISTE include *Problem-Solving Models for Computer Literacy*, *LogoWriter for Educators: A Problem Solving Approach*, *Logo PLUS for Educators: A Problem Solving Approach* (co-authored with Sharon Yoder), and *Effective Inservice for Integrating Computer-as-Tool into the Curriculum*.

"Our educational system is not nearly as good as it could be," says Dave. "We know that computer-related technology can make substantial contributions to improving both the content of the curriculum and the instructional delivery system. Such technology can empower students and teachers."

ISTE believes that computer-related technology must become a tool that students and teachers use routinely if students are to be adequately prepared for adult citizenship in our Information Age society.

ISTE's wide range of periodicals, publications, projects, and other activities mirrors this vision and commitment.

Call us today to order Dave's latest books, and discover how he and ISTE are leading the way for the educators and school systems of tomorrow.

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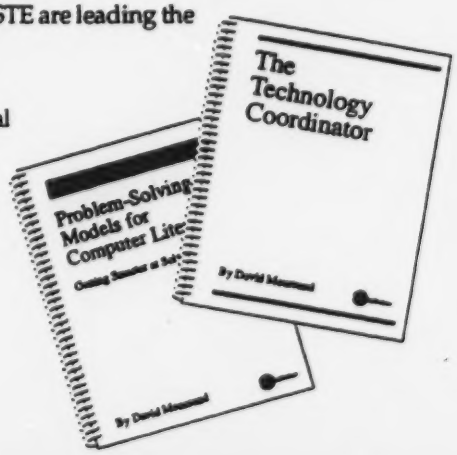

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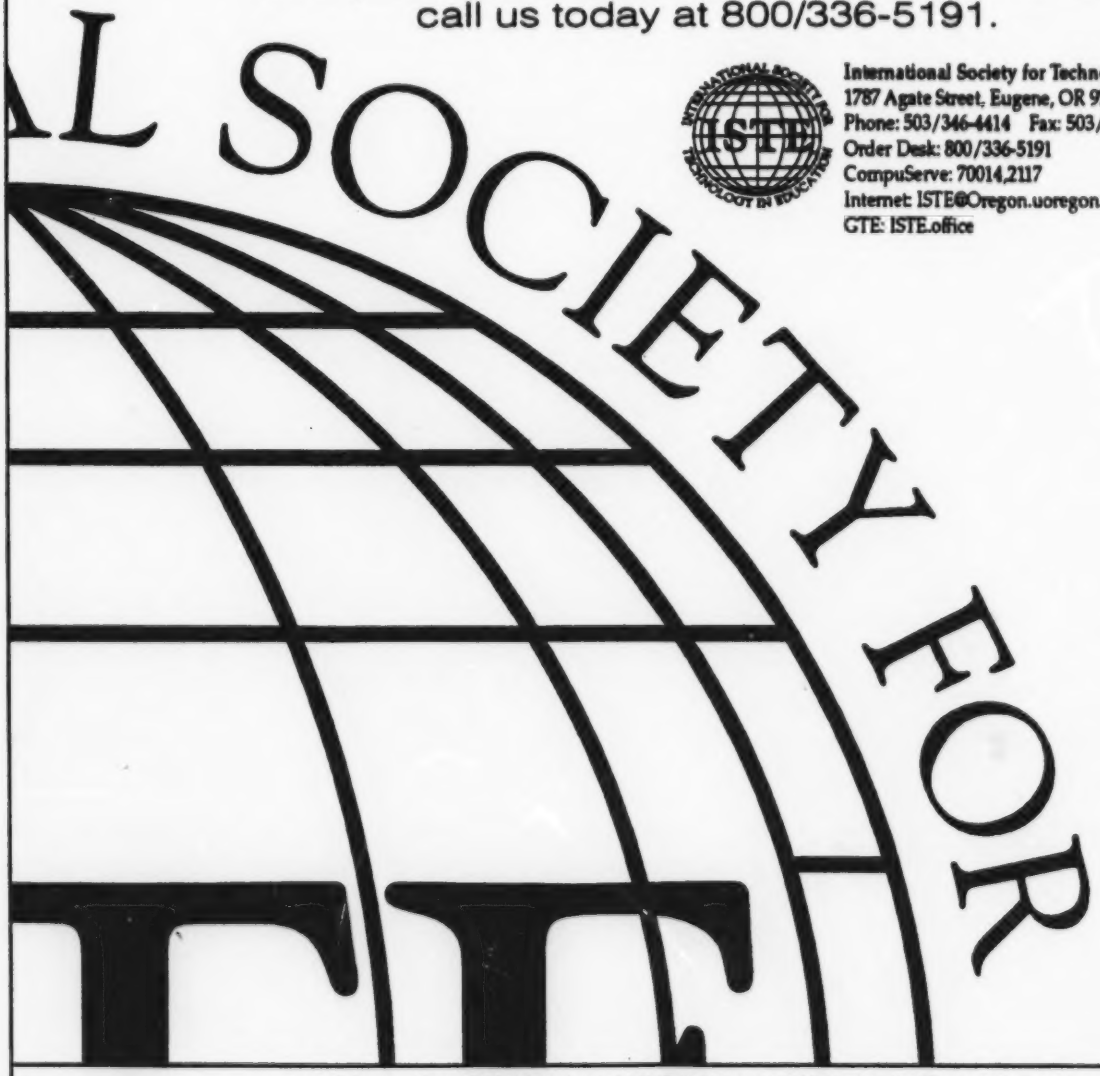

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